η_H < η_f < major losses a) b)
minor " $h_{fm} = k \frac{\bar{v}^2}{2g}$
η_Q

Wirbel = eddy = pusaran

$H_n = H_{br} - \Sigma h_f$

$P = 9.8 \eta Q H_n$ (H_{br}) → P_p

a) Darcy-Weisbach

$h_f = f \frac{L}{D} \frac{v^2}{2g}$ ← $v = \frac{4Q}{\pi D^2}$, $v^2 = \frac{16 Q^2}{\pi^2 D^4}$

$h_f = \frac{8f}{\pi^2 g} \cdot \frac{L}{D^5} Q^2$

b) Strickler

$v = k_s R^{2/3} I_f^{1/2}$

$v^2 = k_s^2 R^{4/3} I_f$ $\quad R = \frac{D}{4}$.

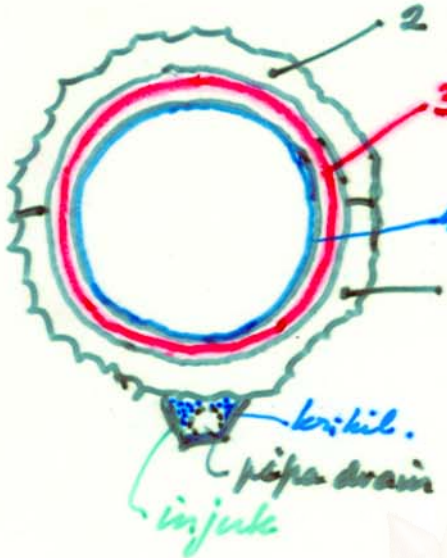
$I_f = \frac{v^2}{k_s^2 R^{4/3}} = \frac{16 Q^2}{\pi^2 k_s^2 R^{4/3} D^4} = C' \frac{Q^2}{D^{5\frac{1}{3}}} = \frac{h_f}{L}$

$h_f = C' \frac{L}{D^{5\frac{1}{3}}} Q^2$

Borda-Carnot

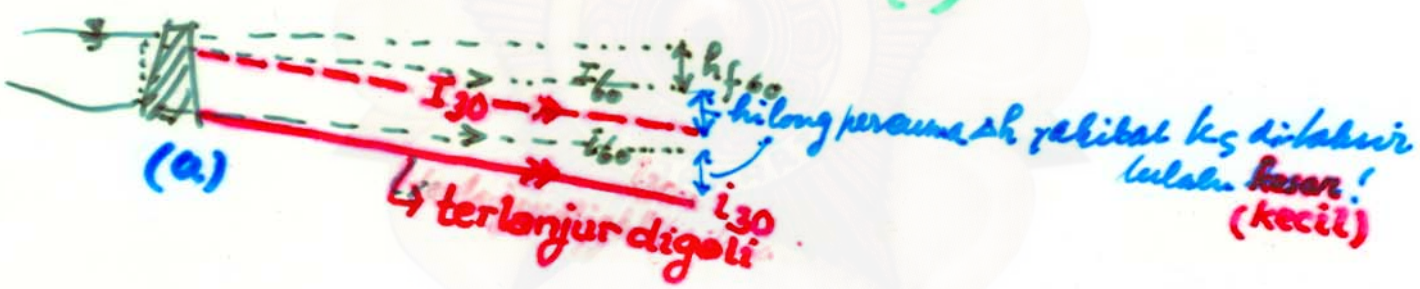
V

✡ Terowong tekan di PLTA TIMO:



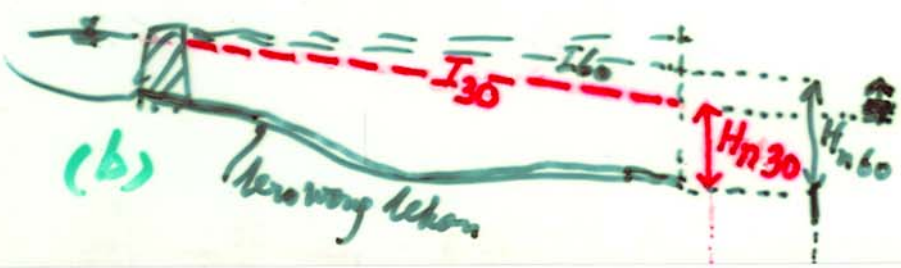
✡ Saluran penghantar terbuka vs. Terowong Tekan

(a) (b)



menentukan Q yg sesungguhnya akan terjadi.

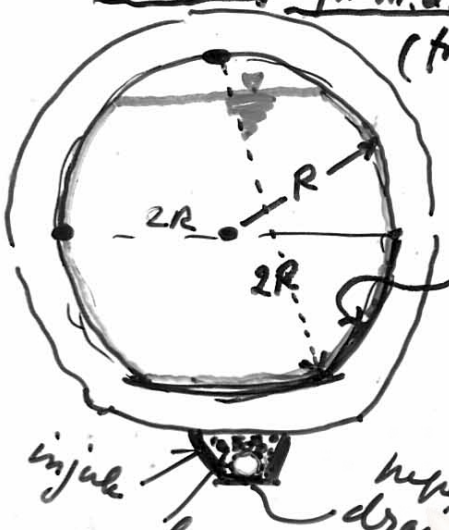
kesalahan pelaksanaan kemiringan saluran
Pelaksanaan hrs teliti



Lebih aman ambil k_s kecil
kemungkinan ΔH_n, kan diberi
I_{30} yg terjadi I_{60} (akan
menyesuaikan sendiri)

Memperbesar η_0 (rendemen bocoran): - lapisan kedap air
- suplesi (TA 18)

1. Terowong dgn m.a. bebas (free flow tunnel)



tapal kuda
horse shoe shape tunnel
lapisan kedap air
1PC : 2 PS.

injak
lubang drain (berlobang)
berikut.

tugas drain: - kering → sehat
- kurangi tek. air tanah

2. Terowong tekan (pressure tunnel)

beton tulang 1 : 1½ : 2
pasangan batu kecil
mortal 1PC : 4 PS

Piagram beban

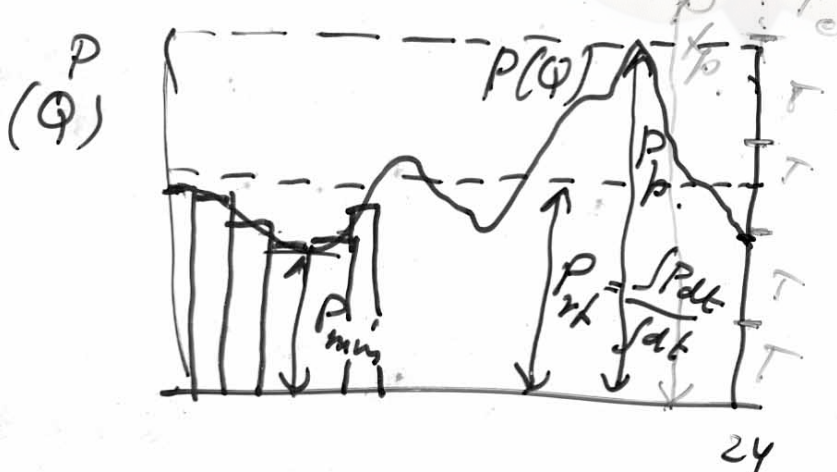
$P = f(t)$ (lihat TA-3)
(" TA-4)

unit load curve

Einheits belastungsganglinien

LF = load factor

$LF = \frac{\int P dt}{P_{max}} = \frac{P_{rt}}{P_p} \times 100\%$



$P = 9.8 \eta Q H_n$

$P(:) Q$

capacity factor = annual plant factor

CF = APF

$= \frac{P_{rt}}{P_{terp.}} \times 100\%$

APF = CF < LF